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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
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| 09/577,835      | 05/25/2000  | Pai-Hung Pan         | M4065.0321/P321-A   | 6233             |

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EXAMINER

NGUYEN, CUONG QUANG

ART UNIT PAPER NUMBER

2811

DATE MAILED: 06/20/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application No.

09/577,835

Applicant(s)

PAN ET AL.

Examiner

Cuong Q Nguyen

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☐ Responsive to communication(s) filed on \_\_\_\_.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 25-30 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 25-30 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.  
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

## Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a) ☐ All b) ☐ Some \* c) ☐ None of:  
1. ☐ Certified copies of the priority documents have been received.  
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_.  
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).  
\* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).  
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

## Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) \_\_\_\_ 6) ☐ Other: \_\_\_\_

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## DETAILED ACTION

### *Claim Rejections - 35 U.S.C. § 103*

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 25-27 and 30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gardner et al. (US 5,899,721) in view of Mogami (US 5,656,519).

Regarding claims 25-27, Gardner et al. discloses an integrated circuit comprising: a semiconductor substrate (10) having a surface; a gate dielectric film (102) formed on the surface of the substrate; a gate electrode stack having continuously vertical sidewalls formed on the gate dielectric film, wherein the gate electrode stack including a polysilicon layer (104) on the gate dielectric layer and a refractory metal silicide layer (122) on the polysilicon layer; a plurality of composite spacers each extending continuously on the vertical sidewalls, wherein each of composite spacers comprises a nitride spacers (114) vertically stacked above an oxide spacer (116) at an intermediate point. See Gardner et al.'s Fig.9.

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Gardner et al. does not teach that the spacer structures extend from a bottom to over a top of the continuously vertical sidewalls.

Mogami discloses a gate structure comprising a spacer structure (9) formed extending from a bottom to over a top of the continuously vertical sidewalls of a gate electrode stack. See Mogami's Fig.8F.

It would have been obvious to one of ordinary skill in the art to form the spacer structure extending from a bottom to over a top of the continuously vertical sidewalls of gate electrode stack as taught by Mogami into Gardner et al.'s device in order to prevent the short circuit between the source/drain regions and gate electrode stack. See Mogami's col.8 lines 5-15.

Regarding claim 30, Gardner et al. does not teach that the spacers have a thickness of 50-500 angstroms. However, the thickness of spacer is an art recognized variable of importance which is subject to routine experimentation and optimization. Therefore, it would have been obvious to one of ordinary skill in the art to arrive the spacer having the thickness as claimed.

Claims 28-29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gardner et al. in view of Mogami and further in view of Bai et al. (US 5,861,340).

Regarding claim 28, Gardner et al. and Mogami substantially teach all the limitations of claims 25-27 as shown above but does not teach that the silicide layer is a

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refractory metal silicide layer and a diffusion barrier layer formed between the polysilicon layer and the silicide layer.

Bai et al. discloses a semiconductor device comprising: a gate stack (222) including a polysilicon layer (204), a conductive diffusion barrier layer (206, a TiN layer) on the polysilicon layer and a refractory metal silicide layer such as cobalt silicide, titanium silicide and platinum silicide. See Bai et al.'s Fig.2C and col.4 lines 16-41.

It would have been obvious to one of ordinary skill in the art to incorporate a conductive diffusion barrier layer between the polysilicon layer and the silicide layer as taught by Bai et al. into the device formed by the combination of Gardner et al. and Mogami because the conductive barrier layer would prevent diffusion of silicon atoms in the polysilicon layer into the silicide layer. See Bai et al.'s col.3 lines 14-18.

Regarding claim 29, the device formed by the combination of Gardner et al., Mogami and Bai et al. has the diffusion barrier layer of TiN which is the same material for forming barrier of present invention. Therefore, the barrier layer of combined device inherently has the same characteristics as claimed device such as the barrier is substantially impermeable to metal atoms.

### ***Response to Arguments***

2. Applicant's arguments with respect to claims 25-30 have been considered but are not persuasive.

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Applicants argue that Mogami reference can not combine to Gardner et al. reference because the spacer in Mogami is formed of oxide not composite oxide nitride as shown in Gardner et al. In response, the teaching of Mogami which was incorporated in to Gardner et al.'s device is the structure of the spacer which is extending above the surface of the gate stack and not the material for forming the spacer. One of ordinary skill in the art would recognize that with the spacer structure extending above the top surface of the gate stack, the silicide material (on top of the gate stack) can not bridge between the gate stack and source/drain region, so the short circuit between the gate stack and source/drain region can be prevented. For those reasons, it is reasonable to one of ordinary skill in the art to incorporate the spacer structure that extends over the top surface of the gate stack into Gardner et al.'s device.

### ***Conclusion***

**3. THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any

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extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

**4. Papers related to this application may be submitted to Technology center (TC) 2800 by facsimile transmission. Papers should be faxed to TC 2800 via the TC 2800 Fax center located in Crystal Plaza 4, room 4-C23. The faxing of such papers must conform with the notice published in the Official Gazette, 1096 OG 30 (November 15, 1989). The Group 2811 Fax Center number is (703) 308-7722 and 308-7724. The Group 2811 Fax Center is to be used only for papers related to Group 2811 applications.**

**5. Any inquiry concerning this communication or any earlier communication from the Examiner should be directed to CUONG Q NGUYEN whose telephone number is (703) 308-1293. The Examiner is in the Office generally between the hours of 6:30 AM to 5:00 PM (Eastern Standard Time) Monday through Thursday.**

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor TOM THOMAS who can be reached on (703) 308-2772. The fax phone number for the organization where this application or proceeding is assigned is (703) 308-7722 or 308-7724.

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Any inquiry of a general nature or relating to the status of this application should be directed to the Technology Center Receptionists whose telephone number is 308-0956.

A handwritten signature in black ink, appearing to read 'Cuong Nguyen', with a stylized, cursive script.

Cuong Nguyen

Primary examiner

June 18, 2003